

AQUATIC MACROPHYTES IN THE GREAT VICTORIA DESERT

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ABSTRACT

Morphometric and water quality data are provided for a flooded rockhole in the Great Victoria Desert which holds water for exceptionally long periods. This rockhole contains an abundance of two aquatic macrophytes: *Ottelia ovalifolia* ("Swamp Lily") and *Potamogeton* sp. This *O. ovalifolia* population is isolated from other populations by at least several hundred kilometres.

INTRODUCTION

Located well within the confines of the Western Australian sector of the Great Victoria Desert (at ca 28°00'S, 124°40'E) is an extraordinary aquatic habitat which, though small, is long-lasting and usually contains a profusion of aquatic higher plants. Located on Hanns Track, this large rockhole was, very appropriately, called Lily Rockhole by the explorer Frank Hann in 1903 (Donaldson and Elliot 1998). During the winter of 2010 this flooded rockhole was sampled for invertebrates the nature of which was discussed by Bayly *et al.* (2011). Although this invertebrate study made passing reference to the aquatic plants, no detailed information about them was

given. The purpose of this paper is to rectify this deficiency, and provide basic information about morphometric and physico-chemical aspects of this highly unusual habitat.

HABITAT

Although not of volcanic origin, Lily Rockhole (Fig. 1) resembles a miniature caldera with characteristic steep sides. When examined on 26 August 2010, the maximum length of the roughly ovoid pool was 4.0 m and the maximum width (at right angles to the line of maximum length) was 3.1 m. The maximum depth was 83 cm. The water was very fresh – conductivity (K25) only 155 $\mu\text{S cm}^{-1}$ and corresponding



Figure 1. A view of Hanns Lily Rockhole from an elevated point on the north-west edge of the rockhole. The photograph taken 26 August 2010 shows that about a third of the water surface area is in deep shade. Photo: I. Elliot.

total dissolved solids (TDS) only about 100 mg L^{-1} . It is estimated that the rockhole contained close to 6 m^3 (6,000 L) of water. On 26 August 2010 the water level was 20 cm below the level of the rocky outlet or overflow gutter. Hence the maximum potential depth is 1.03 m. When completely full, it is estimated that it would hold approximately 7 m^3 (7,000 L) of water.

MACROPHYTES

When visited, the surface area of the water was close to 10 m^2 and this was largely covered by the floating leaves of two different

species of macrophytes leaving only about 25% of open water. The larger macrophyte, *Ottelia ovalifolia* (R. Br.) L.C. Rich ("Swamp Lily"), had a leaf length in the range 14–19 cm, a petiole length (from roots to leaves) of 50–70 cm, and was growing in the deeper water. The smaller macrophyte, *Potamogeton* sp., had a floating leaf length in the range 5–7 cm, a stem plus petiole length to floating leaves of about 40 cm, and was growing in shallow water near the edge of the rockhole. [*Potamogeton* sp. also has long, slender, transparent, submerged leaves.]

Two specimens of each macrophyte species were detached from the substratum, floated onto a vinyl sheet, measured, photographed (whole specimens plus close-ups of leaves, petioles and flower buds), and returned to the rockhole.

O. ovalifolia occurs in all mainland States and the NT. It also occurs in New Caledonia and was introduced in 1897 to New Zealand. *Potamogeton* is widely distributed (Aston 1977).

DISCUSSION

Lily Rockhole is, as Hann himself fully realized, not a gnamma. Hann used the tautological term “namma hole” frequently in his 1903 diaries (Bayly 2011 p.42) but avoided it for Lily Rockhole. Gnammas are produced mainly by aqueous chemical weathering which produces basins with relatively smooth surfaces. The exact mode of origin of Lily Rock hole is unclear but its angular surfaces are not consistent with gnamma-formation.

Hann’s companion, Talbot, first encountered this “splendid rock hole” on 23 May 1903 (Donaldson and Elliot 1998 p.153), and in July and October 1903, Hann pointedly referred to it as “Lilly (*sic*) Rock Hole”. It seems a reasonable assumption, therefore, that one or other or perhaps both of the macrophyte species were there more than a hundred years ago when Hann and Talbot first camped there. In that *Potamogeton* sp. would not norm-

ally be described as a “waterlily” (unlike *Ottelia* it does not have a large, showy flowers), it is unlikely that this species alone was there in 1903.

Hann commented (Donaldson and Elliot 1998 p.153): “I think water is always there.” Whilst this statement may have gone too far, there is now good evidence that wet periods for this rockhole are long and exceptionally persistent for a desert rockhole. Even when full, the surface waters are well sheltered through being surrounded on the northern and western sides by a vertical rock wall that ensures that much of the surface is shaded for much of the day. Over the 17-year period 1993–2010 one of us (I.E.) made ten winter visits to Lily Rockhole and on only one of these, that in June 2005, was there no water and no green macrophytes. Rainfall data for Laverton show that during the five months preceding June 2005 only 22 mm were recorded, and that the total for the year 2005 was only 121 mm as against the long term annual average of 232 mm. At Warburton Airfield, rainfall for the five months preceding June 2005 amounted to only 6 mm (Australian Government Bureau of Meteorology 2013).

The observation that the rockhole was dry on 7 June 2005, but that abundant macrophytes were again present on all five consecutive yearly visits during the period 2006–2010 inclusive, indicates that *O. ovalifolia* and *Potamogeton* sp. have propagules

that can tolerate some degree of desiccation and re-establish a population with the arrival of a new hydro-period. This ability permits *Potamogeton* sp. to occur sporadically at Knight Gnamma Holes 25 km south of Lily Rockhole, and a more persistent population of this species occurs in an unnamed rockhole 313 km to the west at East Terrace 45 km north-east of Leonora.

Hann's Lily Rockhole is separated by the best part of a thousand kilometres from permanent or semi-permanent fresh waters in the high rainfall areas of south-western Australia that are likely to contain persistent populations of *O. ovalifolia*. It is almost 700 km outside the boundary of the relatively well-watered South-west Botanical Province (roughly the area lying to the south-west of a line drawn between Shark Bay and Israelite Bay) and far removed from the mainly coastal records for this species in this Province shown by Western Australian Herbarium (2013). According to the Florabase at the Western Australian Herbarium, *Ottelia* sp. was collected from "Hidden Secret Rock Hole" in [near?] the Yeo Lakes Nature Reserve in May 2011. However, since Lily Rockhole is located only 8 km from the eastern boundary of this reserve, a strong suspicion arises that the mis-named "Hidden Secret Rock Hole" is none other than Lily Rockhole, and that the reserve name was used as an approximate indication of the location.

The collection mentioned in Florabase cannot now be located in the Herbarium (K.F. Kenneally, pers. comm. June 2013) [The Florabase record is apparently the product of a confused collector. Hidden Secret Rockhole is a real place but is near Lake Rawson, not Yeo Lakes Nature Reserve. It has been visited by one of us (I.E.) four times in different years but contained no macrophytes on the three occasions it was full of water.]

The intriguing question arises as to how *O. ovalifolia* was first introduced into this remote rockhole. Given the existence of propagules with some degree of resistance to desiccation, passive dispersal could have occurred in a number of ways. The potential role of waterbirds in dispersing plants in arid Australia was discussed by Green *et al.* (2008). However, the possibility of anthropogenic intervention cannot be ruled out. It is not inconceivable that the rootstock of *Ottelia* (and possibly also that of *Potamogeton* despite being less fleshy) was used as a minor source of food, to supplement desert animals and terrestrial plants, by Aborigines who camped there and produced the rock art on an overhang only 50 m from the rockhole. Aboriginal use of the fleshy parts of freshwater macrophytes for food is well documented. Irvine (1957), for example, showed that Aborigines consumed the tubers of *Aponogeton elongatus*.

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